

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) An X-ray microscopic inspection apparatus having X-ray generating means for generating X-rays by allowing an electron beam from an electron source to impinge on a target for X-ray generation and for inspecting an object ~~to be inspected by~~ utilizing said X-rays, ~~the said X-ray microscopic inspection~~ apparatus comprising:

~~a magnetic superposition lens having a magnetic field generating portion disposed in the vicinity of an electron generating portion of an electron gun;~~

a field emission electron gun having an ultra-high vacuum electron gun chamber, an anode and an electron generating portion, wherein the electron generating portion is adapted to generate electrons and said anode is adapted to generate an electric field to accelerate said electrons;

said field emission electron gun further comprising a magnetic superposition lens including a magnetic circuit and a magnetic field generating portion, wherein said magnetic field generating portion is disposed separately from said ultra-high vacuum electron gun chamber and said magnetic superposition lens is adapted to generate a focusing lens magnetic field having a center,

wherein said magnetic field generating portion is disposed outside of said ultra-high vacuum electron gun chamber,

wherein said electron source of said electron generating portion is disposed substantially in the center of said focusing lens magnetic field and said focusing lens magnetic field is superposed to said electric field thereby reducing a lens aberration of said magnetic superposition lens and reducing a loss amount of said electrons from said electron source by focusing said electrons being accelerated by said electric field,

a scan coil for freely swinging an electron probe, formed via said magnetic superposition lens, on a surface of said target for X-ray generation;
reflected electron detecting means having a detecting portion disposed above said target for X-ray generation scanned by the electron probe, for detecting a reflected electron from said target; and

electron image generating means for performing imaging of a target surface utilizing signals from said reflected electron detecting means, wherein the apparatus is provided for allowing alignment operations including focus adjustment to said target for X-ray generation and astigmatism correction to be performed on ~~the basis~~ a basis of image information from the electron image.

2. (currently amended) An X-ray microscopic inspection apparatus having X-ray generating means for generating X-rays by allowing an electron beam ~~[[,]]~~ from an electron source ~~having an electron generating portion and an anode~~, to impinge on a target for X-ray generation, ~~and for inspecting an object to be inspected by utilizing said X-rays, the said X-ray microscopic inspection apparatus comprising:~~

~~a magnetic superposition lens wherein a magnetic field generating portion is disposed in the vicinity of the electron generating portion of said electron source, so that a magnetic field is superposed with an electric field formed by said electron source at least from the electron generating portion to the anode as a component element of an~~

~~electron accelerating means, so as to produce from said electron source a focused electron beam with a reduced electron beam loss amount by focusing the electrons while accelerating the electrons by said anode just after generating them from the electron generating portion; and~~

a field emission electron gun having an ultra-high vacuum electron gun chamber, an anode and an electron generating portion, wherein the electron generating portion is adapted to generate electrons and said anode is adapted to generate an electric field to accelerate said electrons; and

said field emission electron gun further comprising a magnetic superposition lens including a magnetic circuit and a magnetic field generating portion, wherein said magnetic field generating portion is disposed separately from said ultra-high vacuum electron gun chamber and said magnetic superposition lens is adapted to generate a focusing lens magnetic field having a center,

wherein said magnetic field generating portion is disposed outside of said ultra-high vacuum electron gun chamber,

wherein said electron source of said electron generating portion is disposed substantially in the center of said focusing lens magnetic field and said focusing lens magnetic field is superposed to said electric field thereby reducing a lens aberration of said magnetic superposition lens and reducing a loss amount of said electrons from said electron source by focusing said electrons being accelerated by said electric field,

a scan coil for freely swinging an electron probe formed via said magnetic superposition lens on a surface of said target for X-ray generation.

3. (currently amended) An X-ray microscopic inspection apparatus ~~having X-ray~~
having X-ray generating means for generating X-rays by allowing an electron beam [[,]]

from an electron source ~~having an electron generating portion and an anode~~, to impinge on a target for X-ray generation, ~~and for inspecting an object to be inspected by utilizing said X-rays, the said X-ray microscopic inspection apparatus comprising:~~

~~a magnetic superposition lens wherein a magnetic field generating portion is disposed in the vicinity of the electron generating portion of said electron source, so that a magnetic field is superposed with an electric field formed by said electron source at least from the electron generating portion to the anode as a component element of an electron accelerating means, so as to produce from said electron source a focused electron beam with a reduced electron beam loss amount by focusing the electrons while accelerating the electrons by said anode just after generating them from the electron generating portion; and~~

a field emission electron gun having an ultra-high vacuum electron gun chamber, an anode and an electron generating portion, wherein the electron generating portion is adapted to generate electrons and said anode is adapted to generate an electric field to accelerate said electrons; and

said field emission electron gun further comprising a magnetic superposition lens including a magnetic circuit and a magnetic field generating portion, wherein said magnetic field generating portion is disposed separately from said ultra-high vacuum electron gun chamber and said magnetic superposition lens is adapted to generate a focusing lens magnetic field having a center,

wherein said magnetic field generating portion is disposed outside of said ultra-high vacuum electron gun chamber,

wherein said electron source of said electron generating portion is disposed substantially in the center of said focusing lens magnetic field and said focusing lens magnetic field is superposed to said electric field thereby reducing a lens aberration of

said magnetic superposition lens and reducing a loss amount of said electrons from said electron source by focusing said electrons being accelerated by said electric field,

an electron beam axis alignment coil disposed in the vicinity of the electron generating portion of in an upstream side of said anode and disposed close to said electron source, for aligning an axis of said electron beam allowed to impinge on said target for X-ray generation via said magnetic superposition lens while accelerating the electron beam.

4. (currently amended) An X-ray microscopic inspection apparatus having X-ray generating means for generating X-rays by allowing an electron beam [[,]] from an electron source ~~having an electron generating portion and an anode,~~ to impinge on a target for X-ray generation, and for inspecting an object ~~to be inspected by~~ utilizing said X-rays, the said X-ray microscopic inspection apparatus comprising:

~~a magnetic superposition lens wherein a magnetic field generating portion is disposed in the vicinity of the electron generating portion of said electron source, so that a magnetic field is superposed with an electric field formed by said electron source at least from the electron generating portion to the anode as a component element of an electron accelerating means, so as to produce from said electron source a focused electron beam with a reduced electron beam loss amount by focusing the electrons while accelerating the electrons by said anode just after generating them from the electron generating portion;~~

a field emission electron gun having an ultra-high vacuum electron gun chamber, an anode and an electron generating portion, wherein the electron generating portion is adapted to generate electrons and said anode is adapted to generate an electric field to accelerate said electrons;

said field emission electron gun further comprising a magnetic superposition lens including a magnetic circuit and a magnetic field generating portion, wherein said magnetic field generating portion is disposed separately from said ultra-high vacuum electron gun chamber and said magnetic superposition lens is adapted to generate a focusing lens magnetic field having a center,

wherein said magnetic field generating portion is disposed outside of said ultra-high vacuum electron gun chamber,

wherein said electron source of said electron generating portion is disposed substantially in the center of said focusing lens magnetic field and said focusing lens magnetic field is superposed to said electric field thereby reducing a lens aberration of said magnetic superposition lens and reducing a loss amount of said electrons from said electron source by focusing said electrons being accelerated by said electric field,

electron probe control means for controlling circular scanning of the electron beam on said target by deflecting the focused electron beam ~~scanning an electron beam;~~
and

X-ray CT image generating means for allowing a microstructure of a cross section of interest of said object to be displayed by processing plural sets of images based on data of transmitted X-rays of said object in response to said scanning.

5. (currently amended) An X-ray microscopic inspection apparatus having X-ray generating means for generating X-rays by allowing an electron beam [L] from an electron source ~~having an electron generating portion and an anode,~~ to impinge on a target for X-ray generation, ~~and for inspecting an object to be inspected by utilizing said X-rays, the~~ said X-ray microscopic inspection apparatus comprising:

~~a magnetic superposition lens wherein a magnetic field generating portion is disposed in the vicinity of the electron generating portion of said electron source, so that a magnetic field is superposed with an electric field formed by said electron source at least from the electron generating portion to the anode as a component element of an electron accelerating means, so as to produce from said electron source a focused electron beam with a reduced electron beam loss amount by focusing the electrons while accelerating the electrons by said anode just after generating them from the electron generating portion;~~

a field emission electron gun having an ultra-high vacuum electron gun chamber, an anode and an electron generating portion, wherein the electron generating portion is adapted to generate electrons and said anode is adapted to generate an electric field to accelerate said electrons;

said field emission electron gun further comprising a magnetic superposition lens including a magnetic circuit and a magnetic field generating portion, wherein said magnetic field generating portion is disposed separately from said ultra-high vacuum electron gun chamber and said magnetic superposition lens is adapted to generate a focusing lens magnetic field having a center,

wherein said magnetic field generating portion is disposed outside of said ultra-high vacuum electron gun chamber,

wherein said electron source of said electron generating portion is disposed substantially in the center of said focusing lens magnetic field and said focusing lens magnetic field is superposed to said electric field thereby reducing a lens aberration of said magnetic superposition lens and reducing a loss amount of the electrons from said electron source by focusing said electrons being accelerated by said electric field,

fluorescent X-ray detecting means having a detecting portion disposed in a space between said target and an objective lens and disposed above said object and outside an X-ray target a region of a generation of said X-rays for detecting a fluorescent X-ray generated from said object, wherein said objective lens has a long focal distance and a longer working distance of several centimeters; ~~and~~

elemental analysis means for analyzing elements of said object based on fluorescent X-ray signals from said fluorescent X-ray detecting means ; and

a pin hole ,wherein said pin hole is located between said target and said object and said pin hole is scanned in order to specify a region and positional identification of said object to do an elemental analysis and take a perspective image corresponding to said object by said X-rays passing through said pin hole.

6. (currently amended) An X-ray microscopic inspection apparatus having X-ray generating means for generating X-rays by allowing an electron beam from an electron source to impinge on a target for X-ray generation and for inspecting an object ~~to be inspected by utilizing said X-rays, the said X-ray microscopic inspection~~ apparatus comprising:

~~a magnetic superposition lens having a magnetic field generating portion disposed in the vicinity of an electron generating portion of an electron;~~ and

a field emission electron gun having an ultra-high vacuum electron gun chamber, an anode and an electron generating portion, wherein the electron generating portion is adapted to generate electrons and said anode is adapted to generate an electric field to accelerate said electrons;

said field emission electron gun further comprising a magnetic superposition lens including a magnetic circuit and a magnetic field generating portion, wherein said

magnetic field generating portion is disposed separately from said ultra-high vacuum electron gun chamber and said magnetic superposition lens is adapted to generate a focusing lens magnetic field having a center,

wherein said magnetic field generating portion is disposed outside of said ultra-high vacuum electron gun chamber,

wherein said electron source of said electron generating portion is disposed substantially in the center of said focusing lens magnetic field and said focusing lens magnetic field is superposed to said electric field thereby reducing a lens aberration of said magnetic superposition lens and reducing a loss amount of said electrons from said electron source by focusing said electrons being accelerated by said electric field,

a scan coil for freely swinging an electron probe, formed via said magnetic superposition lens, on a surface of said target for X-ray generation;

~~wherein the~~ said target comprises comprising a plurality of target elements formed by a CVD method or a sputtering method, ~~the said~~ target elements being provided for generating different characteristic X-rays having different wavelengths [[,]] ;

~~wherein the apparatus is arranged so that characteristic X-rays of a wavelength of interest may be generated by swinging said electron probe to a target element appropriate for generating X-rays having the wavelength of interest, depending on a purpose of inspection.~~

reflected electron detecting means for detecting a reflected electron from said target;

electron image generating means for performing imaging of a target surface of said X-ray generating target utilizing signals from said reflected electron detecting means; and

a target selecting means for selecting a target element by swinging said electron probe to a position of an appropriate target element by controlling the current of said scan coil, so that a characteristic X-ray having an appropriate wavelength is generated according to an inspecting purpose; and

wherein said target selecting means has a function of selecting a target element within a plurality of target elements by a user's selecting operation according to said electron image of said target surface.

Claims 7-10 are cancelled without prejudice.

11. (new) An X-ray microscopic inspection apparatus according to Claim 5, wherein said detecting portion comprises of a cadmium telluride semiconductor.